INSTITUTE OF AERONAUTICAL ENGINEERING

(Autonomous)

Dundigal, Hyderabad - 500 043

AERONAUTICAL ENGINEERING

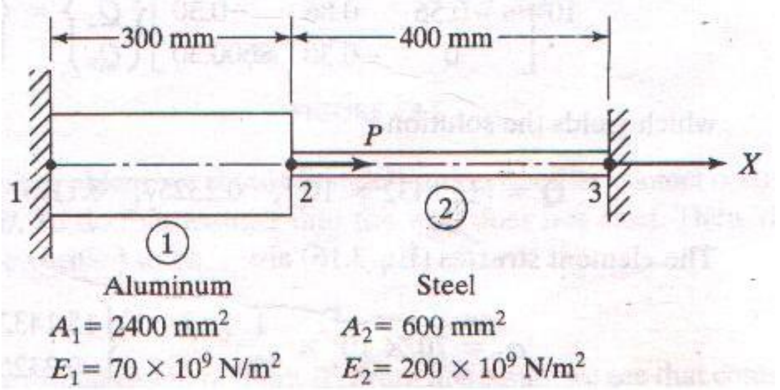
ASSIGNMENT QUESTIONS

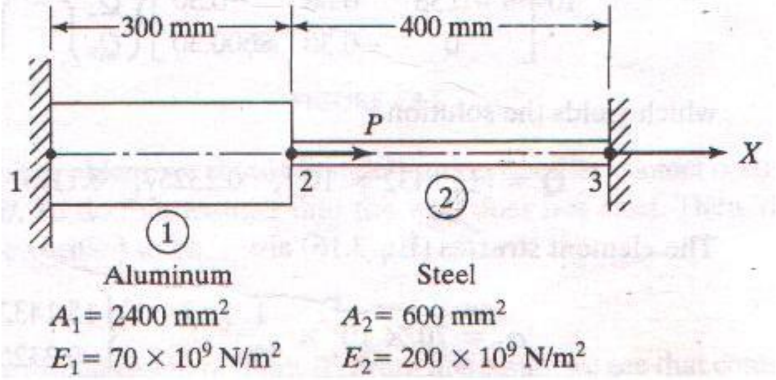
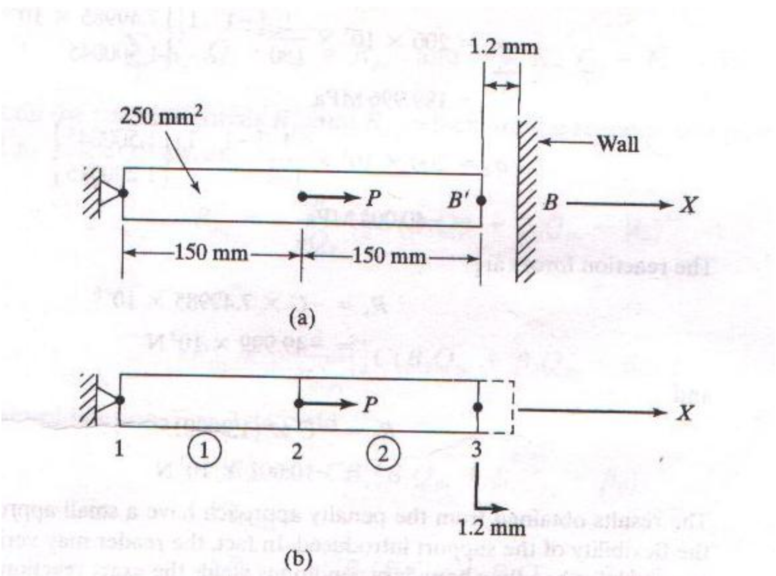
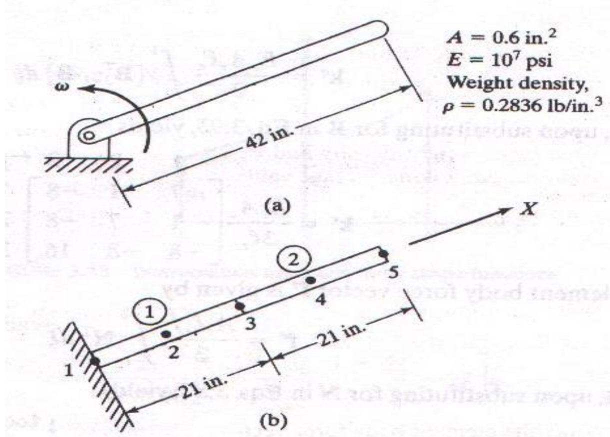
Course Name	:	**FINITE ELEMENT METHODS**
Course Code	:	**A60330**
Class	:	**III - II**
Branch	:	**AERONAUTICAL ENGINEERING**
Year	:	**2017– 2018**
Team of Instructors	:	**Mr G.S.D Madhav**, Asst. Professor Dept of AE **Ms Y.Shwetha**, Asst. Professor, Dept of AE

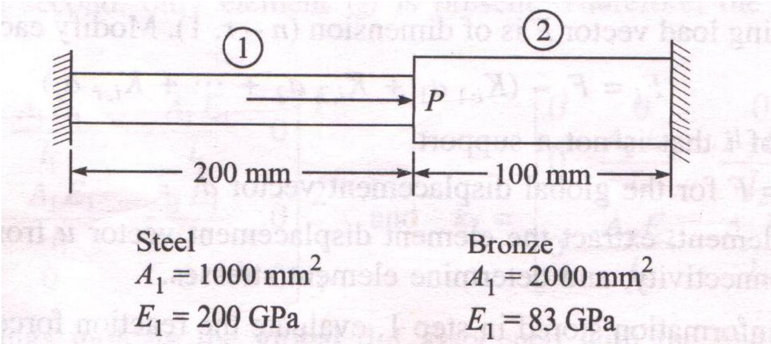
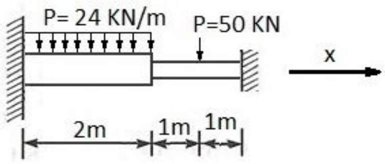
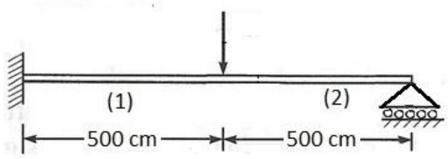
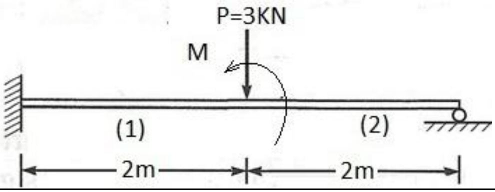
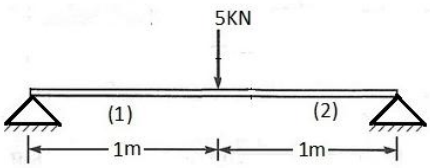
OBJECTIVES:

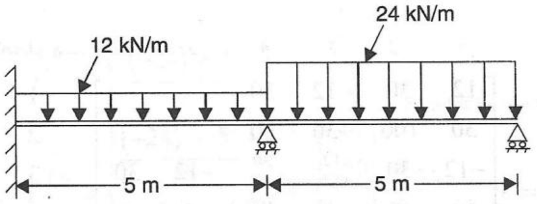
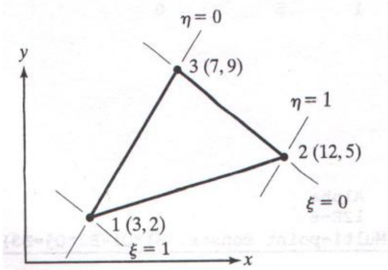
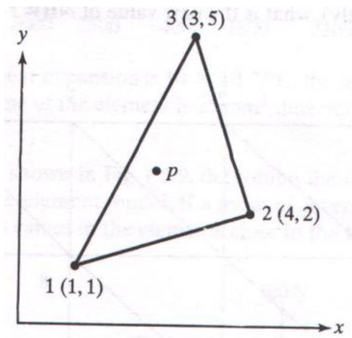
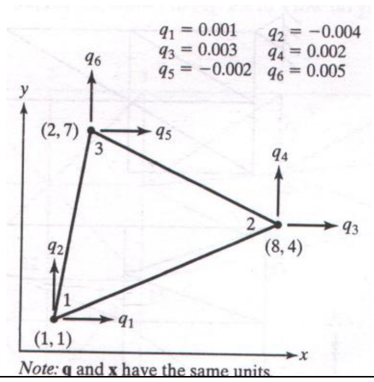
To meet the challenge of ensuring excellence in engineering education, the issue of quality needs to be addressed, debated and taken forward in a systematic manner. Accreditation is the principal means of quality assurance in higher education. The major emphasis of accreditation process is to measure the outcomes of the program that is being accredited.

In line with this, Faculty of Institute of Aeronautical Engineering, Hyderabad has taken a lead in incorporating philosophy of outcome based education in the process of problem solving and career development. So, all students of the institute should understand the depth and approach of course to be taught through this question bank, which will enhance learner's learning process.

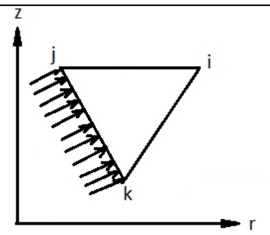
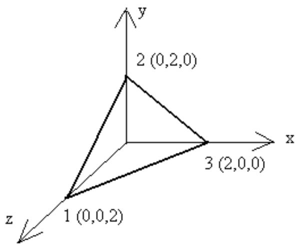
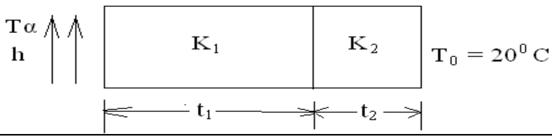
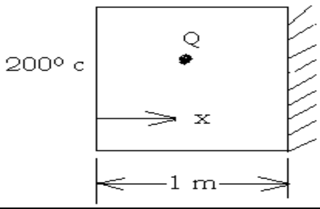
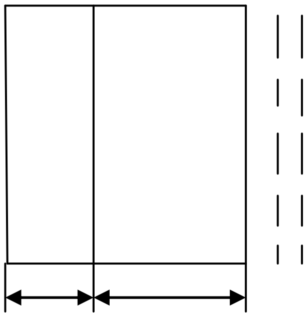
S. No.	Question	Blooms Taxonomy Level	Course Outcome
	ASSIGNMENT-1 **UNIT-1**		
1	Consider the following fig. An axial load P=200 KN is applied as shown. Using penalty approach for handling boundary condtions, do the following a) Determine the nodal displacements. b) Determine the stress in each material. c) Determine the reaction forces.  	Understand	1,2
2	Consider the following fig. An axial load P=200 KN is applied as shown. Using an elimination approach, do the following	Understand	1,2

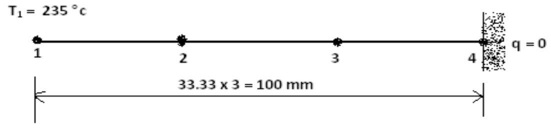
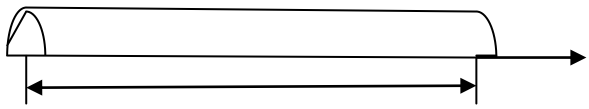
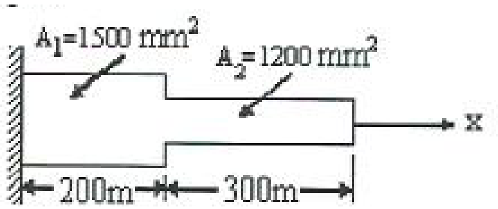
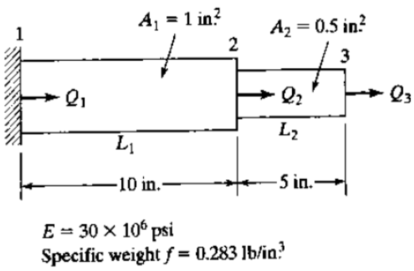
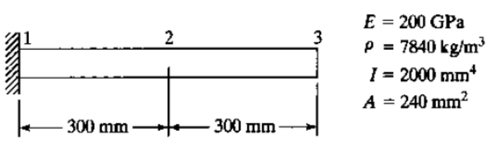
<table>
<tr><td></td><td>a) Determine the nodal displacements.
b) Determine the stress in each material.

</td><td></td><td></td></tr>
<tr><td>3</td><td>In the fig. given below, a load P=60 KN is applied as shown. Determine the displacement field, stress and support reactions in the body. Take E as 20 GPa.

</td><td>Understand</td><td>1,2</td></tr>
<tr><td>4</td><td>Consider the rod (a robot arm), which is rotating at constant angular velocity of 30 rad/s. Determine the axial stress distribution in the rod, using two quadratic elements. Consider only the centrifugal force. Ignore bending of the rod.

</td><td>Understand</td><td>1,2</td></tr>
<tr><td>5</td><td>The structure consists of two bars. An axial load P=200 KN is loaded as shown in fig., determine the following:
a) Element stiffness matrices
b) Global stiffness matrix</td><td>Understand</td><td>1</td></tr>
</table>

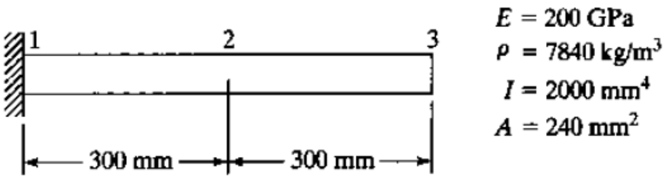
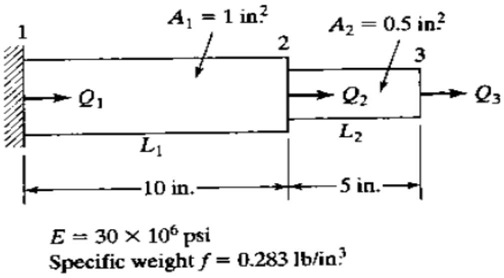
	c) Nodal displacements. d) Stress in each bar.  		
UNIT – II			
S. No.	**Question**	**Blooms Taxonomy Level**	**Course Outcomes**
1	Determine the deflection and slope under the point load for the beam shown in fig given. $E=200\ GP_a$, $I= 4 \times 10^{-6} m^4$, $I_2=2 \times 10^{-6} m^4$.  	Understand	1,2
2	A beam fixed at one end and supported by a roller at the end, has a 20KN concentrated load applied at the centre of the span, as shown in fig. calculate the deflection under the load and construct shear force and bending moment diagram for the beam. Take $E = 20 \times 10^6$ N/c,^{2,} I=2500 $cm^{4.}$  	Understand	1,3
3	Determine the nodal displacements and slopes for the beam shown in fig. find the moment at the mid point of element. Take $E=200\ GP_{a,,}$ $I=5 \times 10^4\ mm^4$, M=6KNM.  	Understand	2,3
4	Determine the nodal displacements and slopes at the position of one-fourth distance from the support of shaft: Take $E=200\ GP_{a,,}$ $I=6 \times 10^4 mm^{4.}$ The shaft is simply supported at A and B.  	Understand	1
5	Apply the beam shown in Figure below by finite element method and determine the end reactions. Also determine the deflections at mid spans given $E=2X10^5 N/mm^2$, and $I=5X10^6\ mm^4$.	Apply	3,1

<table>
<tr><td></td><td>
</td><td></td><td></td></tr>
<tr><td colspan="4">ASSIGNMENT-2
UNIT – III</td></tr>
<tr><td>1</td><td>Determine the jacobian for the (x, y) – (ξ, η) transformation for the element shown in fig, also find the area of the triangle.

</td><td>Understand</td><td>2</td></tr>
<tr><td>2</td><td>For the point P located inside the triangle, the shape functions N_1 and N_2 are 0.15 and 0.25, respectively. Determine the x and y coordinate of P.

</td><td>Understand</td><td>2</td></tr>
<tr><td>3</td><td>For the triangular element shown in fig, obtain strain-displacement relation matrix B and determine the strains ε_x, ε_y and γ_{xy}.

</td><td>Understand</td><td>2, 3</td></tr>
<tr><td>4</td><td>Formulate the element equations for axisymetric element shown in fig

<table><tr><td>node</td><td>R</td><td>z</td></tr><tr><td>i</td><td>5</td><td>5</td></tr><tr><td>j</td><td>1</td><td>5</td></tr><tr><td>k</td><td>3</td><td>2</td></tr></table>E=100Gpa, ν =0.3 ά 5 x10 -6 per deg C
ΔT=60 deg   p=8N/mm2 acting perpendicular to jk side</td><td>Understand</td><td>2, 3</td></tr>
</table>

			
5	Determine the strain displacement matrix for the TETRAHEDRAL element as shown in fig 	Understand	2, 3
UNIT – IV			
1	Determine the temperature distribution through the composite wall shown in figure, when convection heat loss occurs on the left surface. Assume unit area. Assume wall thickness t_1 = 4cm, t_2 = 2cm, k_1 = 0.5w/cm^{0}c, k_2 = 0.05w/cm^{0}c, h= 0.1w/cm$^{2\ 0}$c and T_α= -5^{0}c. 	Apply	3, 4
2	The plane wall shown in fig. The thermal conductivity K = 25W/m^{0}c and there is a uniform generation of heat in the wall of Q = 400W/m^3. Determine the temperature distribution at five nodes (include two sides of the walls) in equal distances through the wall thickness. 	Understand	3, 4
3	Determine the nodal temperature in a composite wall shown in fig 1.4.the wall is mainted at 100 deg c at the left face and convection mode of heat transfer occurs between the right face and existing fluid .take k_1=0.06w/cm deg c and k_2=0.2w/cm deg c. convection co efficient of heat transfer between walls and fluid h=0.1w/cm^{2}deg c and T∞=25 deg c.consider unit area=1 cm^2 perpendicular to the direction of heat flow. 	Understand	3, 4

4	A metallic fin with thermal conductivity K=360W/m^{0}c, 1mm thick and100mm long extends from a plane wall whose temperature is 235^{0}c. Determine the distribution and amount of heat transferred from the fin to air at 20^{0}c with h= 9W/m^{20}c take width of the fin is 1000 mm. Assume tip is insulted.  	Understand	3, 4
5	Determine the temperature distribution in a fin of circular cross section shown in fig1.5.considering two elements,base of the fin is maintained at 100 deg c and tip of the fin is insulated. Thermal conductivity k=2w/cm deg c. Convective heat transfer co-efficient is h=0.2w/cm^{2}deg c. Fluid temperature T_∞20 DEG C,DIAMETRE OF THE FIN=1cm. length=8cm 	Understand	3, 4
UNIT – V			
1	Consider axial vibration of the steel bar shown in Figure below develop the global stiffness and mass matrix and determine the natural frequencies and mode shapes using the characteristic polynomial technique  	Understand	2, 3
2	Determine the Eigenvalues and Eigenvectors for the stepped bar shown in Figure below.  	Understand	2, 3
3	Evaluate the lowest Eigenvalue and the corresponding Eigenmode for the beam shown in Figure below  	Understand	2, 3

4	Evaluate the lowest Eigenvalue and the corresponding Eigenmode for the beam shown in Figure below. 	Understand	2, 3
5	Determine the Eigenvalues and Eigenvectors for the stepped bar shown in Figure below. 	Understand	2, 3

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